

WHAT IS CLAIMED IS:

1. A process for detecting an analyte in a sample to be assayed comprising the steps of:

(a) providing a porous semiconductor substrate having a bound binder compound that forms a binder compound-bound substrate and determining the wavelength of the Fabry-Perot fringes upon illumination of said binder compound-bound substrate;

(b) contacting said binder compound-bound substrate with a sample to be assayed, said analyte present in said binding to said binder compound to form a ligand-bound substrate; and

(c) thereafter reilluminating said substrate; whereby a shift in the wavelength maximum of the Fabry-Perot fringes indicates the detection of said analyte in the sample.

2. The process of claim 1 wherein said porous semiconductor substrate is silicon.

3. The process of claim 1 wherein said binder compound is an organic molecule.

4. The process of claim 1 wherein said analyte is an organic molecule.

5. A process for detecting an organic molecule analyte in a sample to be assayed comprising the steps of:

(a) providing a porous silicon semiconductor substrate having a bound binder compound that forms a binder compound-bound substrate and determining the wavelength of the Fabry-Perot fringes upon illumination of said binder compound-bound substrate;

(b) contacting said binder compound-bound substrate with a sample to be assayed, said organic molecule analyte present in said sample binding to said binder compound to form a analyte-bound substrate; and

(c) thereafter reilluminating said substrate; whereby a shift in the wavelength maximum of the Fabry-Perot fringes indicates the detection of said organic molecule analyte in the sample.

6. The process of claim 5 wherein said provided substrate is prepared by the steps of:

- (a) etching said substrate; and
- (b) washing said etched substrate.

7. The process of claim 5 wherein said binder compound is selected from the group consisting of peptides, antibodies, antigens, DNA, RNA, ligands that bind to metal ions and enzymes.

8. The method of claim 5 wherein said contacting of step (b) is carried out in an aqueous, liquid medium.

9. A process of quantitatively detecting organic analyte molecules in a sample comprising the steps of:

- (a) preparing a porous silicon semiconductor substrate;
- (b) contacting said substrate with a binder compound to form a binder compound-bound substrate and determining the wavelength of the Fabry-Perot fringes upon illumination of said binder compound-bound substrate;
- (c) introducing a sample having an unknown concentration of an organic molecule analyte at a plurality of dilutions and measuring the shift in wavelength of the Fabry-Perot fringes at said dilutions to prepare a first dose

response curve of the unknown concentration of the organic molecule analyte;

(d) providing a second, standard, dose response curve of Fabry-Perot fringe wavelength shifts of known concentrations of the organic molecule analyte; and

(e) comparing said first curve with said second curve on a log vs. log plot to thereby obtain the concentration of said organic molecule analyte in said sample.

10. In a solid state sensor for detecting Fabry-Perot fringes from the reflection of light from a semiconductor substrate, the improvement comprising a semiconductor substrate having a porous surface, said substrate surface having an organic binder compound adsorbed thereon.

11. The sensor of claim 10 further including a solution of an organic compound having an analyte that binds to said organic binder compound, said semiconductor substrate, when containing said analyte bound to said organic binder compound reflecting light to exhibit Fabry-Perot fringe wavelengths different from those exhibited when the analyte is not so bound.

12. A reflective sensor comprising a semiconductor substrate having a porous surface area, said substrate surface area having an organic binder compound intimately associated thereon, said binder compound binding selectively with said analyte.

13. The reflective sensor of claim 12 wherein said semiconductor is a silicious semiconductor.

14. The sensor of claim 13 wherein said silicious semiconductor is selected from the group consisting of intrinsic silicon, p-doped silicon, n-doped silicon, alloys of silicon and mixtures thereof.

15. The sensor of claim 14 wherein said alloys of silicon comprise silicon alloyed with up to about 10% by weight of germanium.

16. The reflective sensor of claim 12 wherein said binder compound is selected from the group consisting of peptides, antibodies, antigens, DNA, RNA, ligands that bind to metal ions and enzymes.

17. The reflective sensor of claim 12 wherein said semiconductor surface defines a plurality of said porous surface areas having an organic binder compound adsorbed thereon.

18. A reflective sensor for an analyte comprising a layer of porous semiconductor with a binder compound for the analyte intimately associated therewith, said layer being substantially transparent and having a top surface and a bottom surface which reflect light to exhibit Fabry-Perot fringes having a first set of characteristic wave lengths in the absence of analyte and a second set of characteristic wave lengths when analyte is present, said second set of characteristic wave lengths being detectably shifted from said first set of characteristic wavelengths.

19. The reflective sensor of claim 18 wherein said layer of porous semiconductor with a binder compound for the analyte intimately associated therewith exhibits a first index

of refraction, wherein said analyte exhibits a second index of refraction which is greater than said first index of refraction, but wherein the second set of characteristic wavelengths is shorter than the first set of characteristic wave lengths.

20. The reflective sensor of claim 19 wherein said semiconductor comprises silicon.

21. An analytical sensor for detecting a target species comprising a porous semiconductor layer of a thickness selected to generate Fabry-Perot fringes from the reflection of light therefrom, said Fabry-Perot fringes having a first set of characteristic peak wavelengths in the absence of the target species and a second set of characteristic peak wavelengths in the presence of the target species with the second set of peak wave lengths being shifted toward shorter wavelengths relative to said first set of wavelengths.

22. The analytical sensor of claim 21 wherein said semiconductor comprises silicon.

23. The analytical sensor of claim 22 wherein the porous silicon has a first index of refraction and said target species has a second index of refraction which is higher than said first index of refraction.

24. The analytical sensor of claim 23 additionally comprising a binder material intimately associated with the porous silicon layer, said binder material specifically binding the target species.

25. A process for detecting a target species in a sample to be assayed comprising the steps of

(a) selecting an assay sensor for the target species, the selected assay sensor comprising a layer of porous semiconductor and a binder material intimately associated therewith, said binder material specifically binding the target species, said layer of a thickness selected to generate Fabry-Perot fringes from the reflection of light therefrom, said Fabry-Perot fringes having a first set of peak wavelengths in the absence of the target species and a second set of peak wavelengths in the presence of the target species; and

(b) reflecting light off of the porous surface of the selected assay sensor in the presence of said sample and determining the presence or absence of the target species in the sample from the Fabry-Perot fringes in the reflected light.

26. The process of claim 25 wherein the porous semiconductor comprises porous silicon.

27. The process of claim 26 wherein the target species is an organic target species.

28. The process of claim 25 wherein said light comprises visible light.

29. The process of claim 25 wherein said light is white light.

30. The process of claim 25 wherein said light comprises infrared light.

31. The process of claim 25 wherein said light comprises ultraviolet light.

32. A reflective sensor array for at least one analyte comprising a layer of porous semiconductor with a plurality of discrete and separate regions having one or more binder compounds for at least one of the at least one analytes intimately associated therewith, said layer being substantially transparent and having a top surface and a bottom surface which reflect light in each of the plurality of regions to exhibit Fabry-Perot fringes for such regions having a first set of characteristic wave lengths in the absence of the at least one analyte and a second set of characteristic wave lengths when analyte is present, said second set of characteristic wave lengths being detectably shifted from said first set of characteristic wavelengths.